Australian Bureau of Statistics

1350.0 - Australian Economic Indicators, 1997
ARCHIVED ISSUE Released at 11:30 AM (CANBERRA TIME) 06/02/1997

1997 Feature Article - Impact of the 1995-96 Farm Season on Australian Production

Introduction

From time to time the changing fortunes of the farm sector have a significant impact on the growth of GDP. While the farm sector's direct contribution to GDP is only about 3 per cent, the indirect effects on other industries also need to be taken into account. For instance, on those occasions when a farm season is better than its predecessor there is an impact on the downstream industries, such as wholesale trade and freight transport. The increased output of agriculture and the downstream industries requires increased inputs, which require the supplying industries to increase their output, which requires their supplying industries to increase their output, and so on. This extra output also leads to extra income; some of which will be spent and will generate further output, which will lead to a further increase in income, and so on. In this way, the so-called multiplier effect magnifies the effect of good and bad farm seasons. If there is a poor season then the multiplier effect is negative. Thus, there are three effects: the primary effect on farm production, the secondary effect on downstream industries and the tertiary effect of the multiplier.

The following analysis shows that the change in fortune of the farm sector had a substantial impact on the quarterly growth rates of the seasonally adjusted constant price estimates of GDP in 1995-96. The primary effect of the 1995-96 farm season added 0.7 percentage points to growth in the September quarter 1995 and a further 0.3 percentage points in the March quarter 1996. The secondary effect on downstream industries was modest, and mainly affected the December quarter 1995 and the March and June quarters 1996.

Farm incomes grew substantially in 1995-96, with growers of wheat and barley being the major beneficiaries. If farmers spent a substantial amount of the extra income they received in 1995-96 shortly after they received it, then they would have boosted GDP growth considerably, particularly in the March quarter.
Unless otherwise stated, the data appearing in this article are either taken from the September quarter 1996 issue of Australian National Accounts: National, Income, Expenditure and Product (cat. no. 5206.0) or underlie those data.

Total impact of the good farm season in 1995-96

To get some idea of the impact of good and bad farm seasons we need only compare 1995-96 with 1994-95. The good season in 1995-96 added
$2,773m to constant price gross farm product, about $60m to wholesale trade and about $80m to transport. Thus, the primary effect was $2,773m and the secondary effect was about $140m (footnote 1). The ABS does not have a firm figure for the tertiary effect, but it is possible to get some idea of its size by using 'total multipliers' derived from the national accounts input-output tables (footnote 2).

The total (value added) multipliers used indicate the increase in Australia's GDP arising from an

increase in output of $1.00 in a particular industry. The total multiplier captures the total effect of the increase in the intermediate inputs an industry requires to produce the additional $1.00 of output and the total effect arising from the increase in income generated by all the increased production. It assumes that no change in the capital stock is required.

The multipliers are determined by the relationships between the total outputs and total inputs of an industry. Such a relationship need not provide a good indicator of the relationship between outputs and inputs at the margin, and so multipliers have to be used judiciously. While the constant price estimates of farm output increased by 14.1 per cent ($3,131m) between 1994-95 and 1995-96, farm inputs only increased by 3.5 per cent ($358m); most of the increase in farm output was simply due to better weather. Therefore, the multiplier effect arising from the increase in farm inputs was relatively small, and so the total multiplier for agriculture cannot be used in these circumstances. A way r ound the problem is to consider the effects from the increases in farm intermediate inputs and farm incomes separately.

The tertiary effect arising from the increase in farm intermediate inputs can be estimated by multiplying the increase by a total multiplier representative of the industries that produced them. A weighted average of the total multipliers for the principal supplying industries is about 1.2 (footnote 3). (It is relatively low because a significant proportion of the petroleum used in Australia is imported.) With a multiplier of this size, the increase in farm intermediate inputs would have led to an increase in GDP of about $430m.

Once an estimate has been made of the amount of extra final expenditures farmers made on household consumption and capital goods, the same approach can be used to estimate the tertiary effect from this source. Given the high level of indebtedness of farmers, there would be a considerable incentive, if not imperative, to use much of the extra income to reduce debt. On the other hand, there would be a need to replace run-down capital stock and a desire to make much wanted household purchases. There is some evidence for an increase in capital expenditure by farmers. For example, the number of tractor sales recorded by the Tractor and Machinery Association of Australia shows an increase of 14.8 per cent between the year starting December quarter 1994 and the year starting December quarter 1995.

Table 1 presents estimates of the tertiary effect arising from greater expenditure on private consumption and capital formation by farmers due to increased farm production in 1995-96 given a number of different assumptions. In the first column it is assumed that farmers spent 20 per cent of the extra income earned in 1995-96. It is assumed the remainder was used to retire debt, pay taxes or put into savings. In the second and third columns it is assumed that they spent 40 per cent and 60 per cent, respectively. It is further assumed that the total multiplier for these expenditures was 1.35 (footnote 4).

TABLE 1 TERTIARY EFFECT DUE TO INCREASED FARM INCOME IN 1995-96(a)

	Extra income spent by farmers		
	20% $m	40% $m	60% $m
Extra expenditure by farmers	558	1,117	1,675
Tertiary effect	754	1,508	2,262

(a) At average 1989-90 prices.

The increase in farm income has to be expressed in a form suitable for deriving the tertiary effect at average 1989-90 prices. This has been achieved by deflating the current price estimates of gross farm product in 1994-95 and 1995-96 with the GDP implicit price deflator (IPD) and then subtracting the measure of real income for 1994-95 from the measure of real income for 1995-96. The increase in real income is $2,792m.

An important feature of the 1995-96 farm season was that prices were considerably higher than they had been in the previous five years. The values of the implicit price deflator (IPD) of gross farm product for the six years from 1990-91 (1989-90 = 100.0) are 75.9, 75.1, 77.7, 80.1, 92.4 and 98.5. The growth of the gross farm product IPD has been much stronger than the GDP IPD over the last two years, and so the strong recovery in prices has given an additional boost to real farm incomes. This has almost certainly led to a larger tertiary effect than would otherwise have been the case.

In addition to the tertiary effects arising from increased expenditures by farmers on intermediate inputs, private consumption and capital expenditure, there is the tertiary effect arising from the increased production of the wholesale trade and transport industries. Total multipliers, which are used to calculate the other tertiary effects, are inappropriate in this case, because the initial multiplier effect is in terms of an increase in value added rather than output. The appropriate multipliers are derived as the ratio of the total multiplier to the initial effect multiplier. These are known as type 2A multipliers. Using type 2A multipliers of 2.225 and 2.281, respectively, the combined secondary and tertiary effects are estimated to be $134m for wholesale trade and $182m for transport. Therefore, the tertiary effects are $74m ($134m - $60m) and $102m ($182m - $80m), respectively.

If the secondary and tertiary effects associated with the increase in production of wholesale trade and transport are added to the tertiary effect arising from the increase in farm intermediate inputs and the primary effect of the increase in farm production, we obtain a figure of $3,519m (i.e. 134 + 182 + 430 + 2,773). If $754m and $2,262m (see Table 1) are taken as the lower and upper bounds of the tertiary effect arising from the increase in farmers' final expenditures, then the total effect (primary, secondary and t ertiary combined) arising from the improvement in farm production between 1994-95 and 1995-96 is somewhere in the range of $4,300m to $5,800m at average 1989-90 prices. This represents between 1.0 and 1.3 per cent of GDP in 1995-96. But not all of the effect took place in 1995-96; some part of the increase will impact on GDP in later periods.

Impact of the good farm season in 1995-96 on the quarter-to-quarter growth rates of GDP in 1995-96. In this section an attempt is made to quantify the impact of the good farm season in 1995-96 on the quarterly movements of seasonally adjusted GDP. To do this it is necessary to determine what effect the change from the poor season in 1994-95 to the good season in 1995-96 had on the seasonally adjusted quarterly estimates in 1995-96.

The impact of the good farm season in 1995-96 had a far from uniform impact on quarterly growth rates through the year. Crops, principally wheat and barley, accounted for nearly all of the increase in farm output in 1995-96. Crop output is recorded in the national accounts only when it is harvested, which is almost exclusively in the December and March quarters. This makes it very difficult to seasonally adjust in a completely satisfactory manner (footnote 5) and presently pseudo-seasonally adjusted estimates are produced.

The method used to "seasonally" adjust farm output of wheat, sugar cane and other crops is to divide the annual production of these crops by four and allocate this amount to each of the four quarters in a financial year. Although this avoids problems that would be associated with the application of standard methods of seasonal adjustment to the production of crops, it introduces a step in such adjusted estimates between the June and September quarters, because it concentrates the whole of the annual change for these crops into the September quarter,

followed by zero growth in the December, March and June quarters. (Furthermore, there is no particular reason why labour input should change much in the September quarter, and so any big change in seasonally adjusted output in that quarter is likely to be reflected in gross product per unit of labour input.)

In seasonally adjusted constant price terms, gross farm product increased by $700m in the September quarter 1995. This was followed by a small fall in the December quarter and an increase of $315m in the March quarter, due to growth in wool production and livestock slaughtering.

Most of the initial impact of a good or bad season on downstream industries and the intermediate inputs used in farm production occurs in the December and March quarters-at the time, or shortly after, the crops are harvested. It is estimated that the seasonally adjusted constant price estimates of gross product for wholesale trade and transport were boosted, in aggregate, by $65m in the December quarter 1995 and by a further $43m in the March quarter 1996. These rises were followed by a fall of about $26m in the June quarter. The bulk of the $358m increase in farm intermediate inputs occurred in the December quarter.

Over $1,700m (nominal dollars) was paid to wheat growers in the December quarter 1995 and over $700m in the March quarter 1996 - roughly double the amount paid in the previous year. The bulk of the former occurred in the month of December.

There are four unknowns that stand in the way of quantifying the total effect of the 1995-96 season on the quarterly estimates of GDP:

- the timing of payments to the growers of crops other than wheat;
- how much of the extra income earned by farmers was spent;
- how quickly farmers spent that part of the extra income; and
- how quickly the multiplier effects work.

Multiplier effects take the form of a geometric progression, and so the bulk of the effects occur in the first few rounds. In reality, each round probably spans a substantial amount of time and has something akin to a chi-squared distribution (roughly bell shaped with a short tail before the peak and and a longer tail afterwards). Given that the nation’s stock of goods is turned over at each stage in the manufacturing-wholesale-retail process about every seven weeks (footnote 6), on average, then the bulk of each round of a multiplier is probably quite short, maybe one or two months. If it is further assumed that multiplier effects follow a simple geometric progression, then the total multiplier effects (including the initial effects) arising from the boost to farm intermediate inputs, wholesale trade and transport on the seasonally adjusted constant price estimates of GDP can be estimated. If each round of the multipliers took one month then these effects would have boosted the December, March and June quarters of 1995-96 by about $359m, $369m and $2 28m, respectively. If each round of the multipliers took two months then the December, March and June quarters of 1995-96 wouldhave been boosted by about $223m, $390m and $212m, respectively (footnote 7).

If all crop growers were paid promptly then the timing of payments would be similar to that of wheat. It seems likely that farmers have spent and will continue to spend some of the extra income over many quarters; but it is also likely that there was a surge in spending shortly after they received their payments. For example, suppose the distribution of their additional expenditure in 1995-96 was 10 per cent in the December quarter, 40 per cent in the March quarter, 20 per cent in the June quarter, and the remaining 30 per cent in subsequent quarters.

Then for the three assumptions of the proportion of extra income spent on private consumption and capital expenditure (i.e. 20 per cent, 40 per cent and 60 per cent) the total multiplier effects would be as shown in table 2 for a one-month multiplier round and table 3 for a two-month multiplier round.

Table 2 shows the quarterly tertiary effects arising from greater expenditure on private consumption and capital formation by farmers due to increased farm income in 1995-96, at average 1989-90 prices, assuming a one-month multiplier round.

TABLE 2 TERTIARY EFFECT FROM HIGHER FARM INCOME: ONE-MONTH MULTIPLIER ROUND(a)

	Extra income spent by farmers		
	20%	40%	60%
	$m	$m	$m
December quarter	40	80	120
March quarter	229	458	687
June quarter	175	350	525
Subsequent quarters	310	620	930
Total	**754**	**1,508**	**2,262**

(a) At average 1989-90 prices.

Table 3 shows the quarterly tertiary effects arising from greater expenditure on private consumption and capital formation by farmers due to increased farm income in 1995-96, at average 1989-90 prices, assuming a one-month multiplier round.

TABLE 3 TERTIARY EFFECT FROM HIGHER FARM INCOME: TWO-MONTH MULTIPLIER ROUND(a)

	Extra income spent by farmers		
	20%	40%	60%
	$m	$m	$m
December quarter	24	48	72
March quarter	187	374	561
June quarter	134	268	402
Subsequent quarters	409	818	1,227
Total	**754**	**1,508**	**2,262**

(a) At average 1989-90 prices.

Table 4 presents the combined secondary and tertiary effects of the 1995-96 farm season by adding the combined secondary and tertiary effects arising from additional farm intermediate inputs and wholesale trade and transport gross product to the figures in Table 3. It is assumed that each multiplier round
takes two months.

TABLE 4 COMBINED SECONDARY & TERTIARY EFFECTS TWO-MONTH MULTIPLIER ROUND(a)

	Extra income spent by farmers 20% $m	40% $m	60% $m
December quarter	247	271	295
March quarter	577	764	951
June quarter	346	480	614
Subsequent quarters	595	1,002	1,411
Total	**1,763**	**2,517**	**3,271**

(a) At average 1989-90 prices.

Tables 5, 6 and 7 demonstrate the impact of the good 1995-96 season on the quarterly movements of the seasonally adjusted and trend constant price estimates of production in 1995-96. For illustrative purposes, the impact of farmers' final expenditures is taken to be the case when 40 per cent of the extra income earned by farmers is spent with the 10:40:20:30 quarterly distribution, described above. It is also assumed that each multiplier round takes two months and the tertiary effects presented above can be regarded as being seasonally adjusted.

TABLE 5 CONTRIBUTIONS TO THE GROWTH OF GDP(A): SEASONALLY ADJUSTED(a)

	Sep % pts	1995-96 Dec % pts	Mar % pts	Jun % pts	June Qtr 1995 to 1996 % pts
Gross farm product, as published	0.7	0.0	0.3	-0.1	0.8
Effect of 1995-96 farm season on farm inputs, wholesale trade and transport	0.0	0.2	0.2	-0.2	0.2
Effect of 1995-96 farm season on farmers' final expenditures	0.0	0.0	0.3	-0.1	0.3
Total effect of 1995-96 farm season	0.7	0.2	0.8	-0.4	1.3
GDP(A) as published	1.7	0.8	2.1	0.1	4.7

(a) At average 1989-90 prices

TABLE 6 IMPACT OF THE GOOD FARM SEASON IN 1995-96 ON PERCENTAGE CHANGES: SEASONALLY ADJUSTED(a)

	Sep %	1995-96 Dec %	Mar %	Jun %	June Qtr 1995 to 1996 %
GDP(A), as published	1.7	0.8	2.1	0.1	4.7
GNFP(A), as published	1.0	0.9	1.8	0.2	4.0
Less					

Effect on farm inputs, wholesale trade and transport	1.0	0.7	1.7	0.4	3.8
Less					
Effect on farmers' final expenditures	1.0	0.6	1.4	0.5	3.6

(a) At average 1989-90 prices

TABLE 7 IMPACT OF THE GOOD FARM SEASON IN 1995-96 ON PERCENTAGE CHANGES: TREND ADJUSTED(a)

	1995-96				June Qtr
	Sep	Dec	Mar	Jun	1995 to 1996
	%	%	%	%	%
GDP(A), as published	1.2	1.4	1.2	0.8	4.7
GNFP(A), as published	0.9	1.2	1.1	0.8	4.1
Less					
Effect on farm inputs, wholesale trade and transport	0.8	1.1	1.0	0.7	3.7
Less					
Effect on farmers' final expenditures	0.8	1.0	0.9	0.6	3.4

(a) At average 1989-90 prices

Conclusion

This analysis shows that the change in fortune of the farm sector had a substantial impact on the quarterly growth rates of GDP in 1995-96. For example, table 5 shows that, under the assumptions described above, the good farm season in 1995-96 contributed 1.3 percentage points to the growth of the seasonally adjusted constant price estimates of GDP(A) between the June quarter 1995 and the June quarter 1996. Of this contribution, 0.8 percentage points were due to the primary effect of growth in gross farm product; 0.2 percentage points were due to the combined secondary and tertiary effects of the growth in farm intermediate inputs, wholesale trade and transport; and 0.3 percentage points were due to the tertiary effect arising from higher final expenditures by farmers. However, while the extent and timing of the primary and the secondary effects are defined reasonably well, the same cannot be said of the tertiary effects: a number of important assumptions have to be made to derive estimates of them. Clearly, the most critical assumptions concern the extent and timing of final expenditures by farmers from the increased income they received in 1995-96. If they spent a substantial amount of the extra income shortly after they received it, then they would have boosted GDP grow th considerably, particularly in the March quarter.

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Footnotes

1 For annual estimates of gross farm product at average 1989-90 prices see table 49 of

Australian National Accounts: National Income, Expenditure and Product (5206.0). Estimates of the increases in the constant price estimates of gross product for wholesale trade and transport attributable to the better farm season in 1995-96 have been made using sales data from the Australian Wheat Board and the Australian Barley Board, and margins and value added data from the 1989-90 and 1992-93 issues of Australian National Accounts: Input-Output Tables (5209.0).< Back >

2 See Information Paper, Australian National Accounts: Introduction to Input-Output Multipliers (5246.0) for a comprehensive description. The multipliers used in this analysis are gross value added multipliers derived from data presented in the 1992-93 issue of Australian National Accounts: Input-Output Tables (5209.0). They are not published, but are available on request from Dr Annette Barbetti on Canberra (06)252 6908. The multipliers have been derived following a direct allocation of competing imports. This means that the multipliers take account of an increase in imports arising from an increase in expenditure in determining the impact on GDP.< Back >

3 The total multiplier for farm intermediate inputs has been derived by taking a weighted average of the total multipliers for the following industries (total multipliers followed by the weights are shown in brackets): Agriculture (1.219, 0.2), Petroleum and coal products (0.815, 0.2), Chemicals (1.141, 0.2), Repairs (1.308, 0.1), Transport and storage (1.336, 0.15) and Wholesale trade (1.537, 0.15).< Back >

4 The total multiplier for farmers' final expenditures has been derived by taking a weighted average of the total multipliers for the following industries (total multipliers followed by the weights are shown in brackets): Clothing and footwear (1.224, 0.1), Transport equipment (1.212, 0.2) Other machinery and equipment (1.250, 0.3), Construction (1.402, 0.1), Wholesale trade (1.537, 0.1) and Retail trade (1.589, 0.2).< Back >

5 The problem encountered with the seasonal adjustment of crops arises because output does not occur in all quarters. The most common seasonal adjustment method used by the ABS is called the 'multiplicative method'. The original figures are divided by seasonal factors that are greater than one for seasonally high quarters and less than one for seasonally low quarters. Clearly, this method cannot be used for series such as crops which have zero output for some quarters every year. The 'additive method' is used by the ABS for series that have both positive and negative values, such as increase in farm stocks. Seasonal factors that are positive for seasonally high quarters and negative for seasonally low quarters are subtracted from the original figures. But when this method is applied to crop output it can lead to negative seasonally adjusted figures in the December and March quarters in years of low output, an outcome which makes no sense.
For the production-based measure of GDP, GDP(P), the primary effect of a good or bad crop season on the seasonally adjusted figures is in the September quarter via the gross product of agriculture. For both the income-based measure of GDP, GDP(I), and the expenditure-based measure of GDP, GDP(E), the primary effects are also in the September quarter. For GDP(I) it is via the gross operating surplus of agriculture (derived as seasonally adjusted output less seasonally adjusted costs) and for GDP(E) it is via the change in stocks (in subsequent quarters the rundown in stocks is offset by an increase in exports).< Back >

6 On average, in 1995-96, stocks were turned over in 7.5 weeks by manufacturers, 6.7 weeks by wholesalers, and 6.8 weeks by retailers. These figures have been derived from current price estimates of the average level of stocks in 1995-96 and the total sales for 1995-96 from Stocks, Selected Industry Sales and Expected Sales, Australia (5629.0) and Retail Trade, Australia (8501.0). < Back >

7 If the multiplier effects following the initial effect follow a simple geometric progress ion, then the effect in the nth round is equal to the initial effect multiplier multiplied by rn, where r = (m - i)/

m. For farm intermediate inputs and farmers’ final expenditures, m is the total multiplier and i is the initial effect multiplier. For wholesale trade and transport, m is the type 2A multiplier and the initial effect multiplier is equal to 1. n = 0 for the initial effect, n =1 for the first round, n = 2 for the second round, and so on. The following assumptions have been made also: the whole of the farm sector’s extra intermediate inputs in 1995-96 were purchased at the end of November 1995; and the additional gross product of wholesale trade and transport and the extra final expenditures by farmers in 1995-96 took effect at the end of November 1995, the end of January 1996 and the end of April 1996. < Back >

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